October XX, 2016

Permit: APC-2017/0044-OPERATION (VOC RACT)(SM)

Hercules, LLC
R&D Spray Drying Process
Hercules Research Center
500 Hercules Road
Wilmington, DE 19808

ATTENTION: Thomas P. Baker
EHS Manager

Dear Mr. Baker:

Pursuant to 7 **DE Admin. Code** 1102, Section 2, approval of the Department of Natural Resources and Environmental Control (the Department) is hereby granted for the operation of the following equipment located at the Hercules Research Center in Wilmington, Delaware.

1) Two PSD-1 Spray Dryers with condensers (R&D and GMP) ,
2) One SD Micro Spray Dryer,
3) One MP-1 Fluid Bed Dryer, and
4) One carbon adsorption system made up of two, 2000 pound carbon canister beds in series.

In addition to the above, the Company may separately register other emission units in accordance with Section 2.1 of 7 **DE Admin. Code** 1102, provided that the emissions associated with these activities do not, when combined with the allowable emissions of this permit, allow emissions of any pollutant to exceed the major source threshold for that pollutant.

This permit is issued in accordance with the following documents where more recent documents may supersede older documents:

1) Application submitted on Form Nos. AQM-1, AQM-2, AQM-3.1, AQM-4.2, and AQM-5 dated May 17, 2016 signed by Michael Hassman, Director,
2) Supplemental information received October 23, 2015, November 29, 2015, December 22, 2015, May 25, 2016, and August 5, 2016.

This permit is issued subject to the following conditions all of which are federally enforceable except Condition 2.4:

1. General Provisions

1.1 Hercules, LCC. agrees that all limits, restrictions and requirements in this permit are necessary to limit their potential to emit below major source thresholds. Violation of any limit, restriction or requirement contained herein may be grounds for suspension or revocation of the permit or other enforcement action for noncompliance with the permit, the failure to apply for a Title V permit, or the failure to obtain a Title V permit.

1.2 Representatives of the Department may, at any reasonable time, inspect this facility.

1.3 This permit may not be transferred to another location or to another piece of equipment or process.

1.4 This permit may not be transferred to another person, owner, or operator unless the transfer has been approved in advance by the Department. Approval (or disapproval) of the permit transfer will be provided by the Department in writing. A request for a permit transfer shall be received by the Department at least thirty (30) days before the date of the requested permit transfer. This request shall include:

1.4.1 Signed letters from each person stating the permit transfer is agreeable to each person; and

1.4.2 An Applicant Background Information Questionnaire pursuant to 7 Del C, Chapter 79 if the person receiving the permit has not been issued any permits by the Department in the previous five (5) years.

1.5 The owner or operator shall not initiate construction, install, or alter any equipment or facility or air contaminant control device which will emit or prevent the emission of an air contaminant prior to submitting an application to the Department pursuant to 7 **DE Admin. Code** 1102, and, when applicable 7 **DE Admin. Code** 1125, and receiving approval of such application from the Department; except as exempted in 7 **DE Admin. Code 1102** Section 2.2.

2. Emission Limitations

2.1 Air contaminant emission levels shall not exceed those specified in 7 **DE Admin. Code** 1100 and the following:

Table 1 – Allowable Emissions From R&D Spray Drying Processes

Condition	Pollutant	Type	Emission Rate (lbs/hr)	Annual Emissions 12 Month Rolling (TPY)
2.1.1	Ethanol	VOC	0.75	**1.1**
2.1.2	Isopropyl Alcohol	VOC	0.72	**1.1**
2.1.3	Ethyl Acetate	VOC	1.08	**1.6**
2.1.4	Tetrahydrofuran	VOC	1.50	**2.2**
2.1.5	Methanol	VOC - HAP	0.67	**1.1**

2.1.6	Methylene Chloride	HAP	2.09	**3.1**
2.1.7	Acetone	Non-VOC Non-HAP	2.00	**2.9**
2.1.8	**VOCs**		**1.7**	**2.5**
2.1.9	**HAPs**		**2.1**	**3.1**

2.2 Emissions from the spray drying process shall not exceed 0.2 grains/scf.

2.3 No person shall cause or allow the emission of visible air contaminants and/or smoke from a stationary or mobile source, the shade or appearance of which is greater than twenty (20) percent opacity for an aggregate of more than three (3) minutes in any one (1) hour or more than fifteen (15) minutes in any twenty-four (24) hour period.

2.4 Odors from this source shall not be detectable beyond the plant property line in sufficient quantities such as to cause a condition of air pollution.

2.5 Emissions from this facility, including emissions from all sources registered in accordance with 7 **DE Admin. Code** 1102 shall not exceed the major source threshold for any pollutant as established by the definition of a "major source" in 7 **DE Admin. Code** 1130.

3. Operational Limitations

3.1 The owner or operator shall comply with the following operational limits:

3.1.1 PSD-1 Spray Dryers (R&D and GMP):

3.1.1.1 Spray Dryers

3.1.1.1.1 The solvent spray rate shall not exceed 8.8 lbs/hr (4 kg/hr).

3.1.1.1.2 The dryers shall only be operated when both the condenser system and carbon adsorption system are operating and functioning properly.

3.1.1.2 Condenser System

3.1.1.2.1 Temperatures must remain below the maximum threshold of each solvent as provided by in the Company's technical data submitted October 23, 2015 and shown in Appendix B.

3.1.2 SD Micro Spray Dryer

3.1.2.1 Spray Dryer

3.1.2.1.1 The solvent spray rate shall not exceed 3.3 lbs/hr (1.5 kg/hr).

3.1.2.1.2 The dryer shall only be operated when the carbon adsorption system is operating and functioning properly.

3.1.3 MP-1 Fluid Bed

3.1.3.1 Spray Dryer

3.1.3.1.1 The solvent spray rate shall not exceed 2.2 lbs/hr (1 kg/hr).

3.1.3.1.2 The dryer shall only be operated when the carbon adsorption system is operating and functioning properly.

3.1.4 Carbon Adsorption System

3.1.4.1 The VOC/HAP removal efficiency shall be maintained at or higher than 90%. This removal efficiency shall be demonstrated by following the Standard Operating Procedures for the use of Carbon Bed Adsorbers including the following practices:

3.1.4.2 For each spray dryer venting through the carbon adsorber system, the facility shall maintain a Carbon Bed Usage Log (CBUL) to track the amount of solvent entering the carbon beds.

3.1.4.3 A weekly check will be performed between the two carbon beds when the spray dryer process is operating and the carbon bed will be changed when breakthrough is detected.

3.1.4.4 The facility shall maintain the Carbon Adsorption System according to the manufacturer's recommendations.

3.2 The owner or operator shall not cause, allow, or permit the disposal of more than eleven pounds of any VOC or of any materials containing more than eleven pounds of VOCs in any one day in a manner that would permit the evaporation of VOCs into the ambient air. This includes, but is not limited to the disposal of VOCs from any VOC control device.

3.3 The owner or operator shall not use open containers for the storage or disposal of cloth or paper impregnated with VOCs that are used for surface preparation, cleanup, or coating removal. Containers for the storage or disposal of cloth or paper impregnated with VOCs shall be kept closed, except when adding or removing material.

3.4 The owner or operator shall not store in open containers spent or fresh VOCs to be used for surface preparation, cleanup, or coating removal. Containers for the storage of spent or fresh VOCs shall be kept closed, except when adding or removing material.

3.5 The owner or operator shall not use VOCs for the cleanup of spray equipment unless equipment is used to collect the cleaning compounds and to minimize their evaporation into the atmosphere.

3.6 The owner or operator shall:

3.6.1 Convey VOC containing cleaning materials from one location to another in closed containers or pipes;

3.6.2 Handle and transfer all fresh and spent cleaning solvent and other VOC containing material to or from any container, tank, vat, vessel, mixing vessel, or piping system, etc. in such a manner that minimizes spills and other losses; and

3.6.3 Clean up spills of fresh and spent cleaning solvent and other VOC containing material immediately.

3.7 The owner or operator shall minimize air circulation around cleaning operations and shall implement equipment practices that minimize emissions including keeping parts cleaners covered when not in use and maintaining cleaning equipment to repair solvent leaks.

3.8 At all times, including periods of startup, shutdown, and malfunction, the owner or operator shall, to the extent practicable, maintain and operate the facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating procedures are being used will be based on information available to the Department which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source.

3.9 All structural and mechanical components of the equipment or process covered by this Permit shall be maintained in proper operating condition.

4. Testing and Monitoring Requirements

4.1 The Department reserves the right to require that the owner or operator perform emission tests using methods approved in advance by the Department.

4.1.1 One (1) original and one (1) copy test protocol shall be submitted a minimum of forty-five (45) days in advance of the tentative test date to the addresses in Condition 4.1.3. The tests shall be conducted in accordance with the State of Delaware and Federal requirements.

4.1.2 The test protocol shall be approved by the Department prior to initiating any testing. Upon approval of the test protocol the Company shall schedule the compliance demonstration with the Source Testing Engineer. The Department must observe the test for the results to be considered in acceptance.

4.1.3 The final results of the testing shall be submitted to the Department within sixty (60) days of the test completion. One (1) original and one (1) copy of the test report shall be submitted to the addresses below:

Original to:
Engineering and Compliance Branch
Attn: Permitting Engineer
Division of Air Quality
State Street Commons
100 W. Water Street, Suite 6A
Dover, DE 19904

One (1) Copy to:
Engineering and Compliance Branch
Attn: Source Testing
Division of Air Quality
715 Grantham Lane
New Castle, DE 19720

4.1.4 The final report of the results must meet the following requirements to be considered valid:

4.1.4.1 The full report shall include the emission test report (including raw data from the test) as well as a summary of the results and statement of compliance or non-compliance with permit conditions;

4.1.4.2 Summary of Results and Statement of Compliance or Non-Compliance
The owner or operator shall supplement the report from the emissions testing firm with a summary of results that includes the following information:

4.1.4.2.1 A statement that the owner or operator has reviewed the report from the emissions testing firm and agrees with the findings.

4.1.4.2.2 Permit number(s) and condition(s) which are the basis for the compliance evaluation.

4.1.4.2.3 Summary of results with respect to each permit condition.

4.1.4.2.4 Statement of compliance or non-compliance with each permit condition.

4.1.5 The results must demonstrate to the Department's satisfaction that the emission unit is operating in compliance with the applicable regulations and conditions of this permit; if the final report of the test results shows non-compliance the owner or operator shall propose corrective action(s). Failure to demonstrate compliance through the test may result in enforcement action.

4.2 The owner or operator shall monitor work practice standards for the handling, storage, and disposal of VOCs and employee training records on an annual basis and update records as needed.

5. Record Keeping Requirements

5.1 The owner or operator shall maintain all records necessary for determining compliance with this permit in a readily accessible location for five (5) years and shall make these records available to the Department upon written or verbal request.

5.2 The owner or operator shall maintain the following information:

5.2.1 Records for each batch of product processed in each dryer including the following:
5.2.1.1 VOC and HAP content;
5.2.1.2 The spray rate;
5.2.1.3 Number of batches per rolling twelve month period; and
5.2.1.4 Hours per batch.

5.2.2 Records for the carbon adsorption system shall include the following:
5.2.2.1 Carbon Bed Usage Log (CBUL).
5.2.2.2 Records of carbon canister change out; and
5.2.2.3 Records of the weekly check performed between the two carbon beds.

5.2.3 Records of all maintenance performed on these units shall be maintained and made available to the Department upon request.

5.2.4 Material Safety Data Sheets or other product documentation shall be kept in file for Department review.

5.2.5 The owner or operator shall maintain a record of all postings and employee training related to these work practice standards and the storage, use, and disposal of VOCs.

5.3 The rolling twelve (12) month total emissions shall be calculated and recorded each month in a log for each of the following pollutants.

5.3.1 Ethanol
5.3.2 Isopropyl Alcohol
5.3.3 Ethyl Acetate
5.3.4 Tetrahydrofuran
5.3.5 Methanol
5.3.6 Methylene Chloride
5.3.7 Acetone
5.3.8 Total Volatile Organic Compounds
5.3.9 Total Hazardous Air Pollutants

6. Reporting Requirements

6.1 Emissions in excess of any permit condition or emissions which create a condition of air pollution shall be reported to the Department immediately upon discovery by calling the Environmental Emergency Notification and Complaint number, (800) 662-8802.

6.2 In addition to complying with condition 6.1 of this permit, any reporting required by 7 **DE Admin. Code** 1203 "**Reporting of a Discharge of a Pollutant or an Air Contaminant**", and any other reporting requirements mandated by the State of Delaware, the owner or operator shall for each occurrence of excess emissions, within thirty (30) calendar days of becoming aware of such occurrence, supply the Department in writing with the following information:

6.2.1 The name and location of the facility;

6.2.2 The subject source(s) that caused the excess emissions;

6.2.3 The time and date of the first observation of the excess emissions;

6.2.4 The cause and expected duration of the excess emissions;

6.2.5 For sources subject to numerical emission limitations, the estimated rate of emissions (expressed in the units of the applicable emission limitation) and the operating data and calculations used in determining the magnitude of the excess emissions; and

6.2.6 The proposed corrective actions and schedule to correct the conditions causing the excess emissions.

6.3 One (1) original and one (1) copy of all required reports shall be sent to the address below:

Division of Air Quality
State Street Commons
100 W. Water Street, Suite 6A
Dover, DE 19901

7. Administrative Conditions

7.1 This permit supersedes **Permit: APC-2012/0097-OPERATION**, and **Permit: APC-2013/0083-CONSTRUCTION (VOC RACT)(MACT)(FE)**.

7.2 This permit shall be made available on the premises.

7.3 Failure to comply with the provisions of this permit may be grounds for suspension or revocation.

Sincerely,

Paul E. Foster, P.E.
Program Manager
Engineering & Compliance Branch

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pc: Dover File

APPENDIX A

Emission Unit Control Devices

Spray Dryer	Condenser	Carbon Bed
PSD-1 GMP	YES	YES
PSD-1 R&D	YES	YES
SD Micro	NO	YES
MP-1 Fluid Bed	NO	YES

APPENDIX B

Maximum Condenser Temperatures of Solvent

Solvent	Maximum Condenser Temperature (^{O}C)
Ethanol	5
Isopropyl Alcohol	5
Ethyl Acetate	5
Tetrahydrofuran	5
Methanol	5
Methylene Chloride	-10
Acetone	5